IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 10/435,008	Confirmation No.:	3596
Applicant(s)	: Dang et al.		
Filed	: January 12, 2004		
TC/AU	: 1711		
Examiner	: Duc Truong		
Docket No.	: AFD 645		
Customer No.:	26902		

Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

DECLARATION OF JAR-WHA LEE
Under Rule 1.131

1. I, Jar-Wha Lee, declare that:

2. I have a B.S. in Chemistry from the Fu-Jen Catholic University, Taiwan, Republic of China, an M.S. and Ph.D. in Mechanics and Material Science from the Rutgers, the State University of New Jersey, New Brunswick, New Jersey.

3. I worked in research and development in the Polymer Chemistry/Polymeric Materials art in the Polymer Branch, Wright-Patterson Air Force Base as a Visiting Scientist from 1992 to 1998. Currently, I am the President of Syscom Technology, Inc., a advanced polymeric material company.

4. I am one of the inventors of the subject matter of the above-identified application.

5. The following facts show a conception and reduction to practice of the above-identified invention before April 7, 2002:

Before April 7, 2002, I developed new rigid-rod benzobisazole polymer compositions incorporating 1,5-naphthalene-diyl units for potential utilization as non-conducting high modulus fibers in structural composites for Air Force applications. Besides conventional reinforcement, other areas of application for these high performance polymers include protective garments, ballistic vests and abrasion- and flame-resistant fabrics. The invention takes advantage of the unique conformational possibilities and torsional behavior of the polybenzobisazole chains containing 1,5-naphthalic segments which will influence the mechanical properties of the polymeric fibers. This development is described in University of Dayton Research Institute (hereinafter referred to as "UDRI") Technology Disclosure No.349. A copy of this Technology Disclosure Form is attached.

In particular, the Page 3 of 5 of the attached Technology Disclosure Form show that the relevant dates are as follows:

1,5-Naphthalenedicarboxylic acid (monomer) (07/23/01):

A new method is described for the preparation of this diacid monomer starting with 1,5-diaminonaphthalene as starting material. The process of conversion of 1,5-naphthalenedinitrile to the dicarboxylic acid monomer is described with the date of 07/23/01.

1,5-Naphthalenebenzobisthiazole (polymer) (08/28/01 and again, 11/27/01):

The high temperature polycondensation of 1,5-naphthalenedicarboxylic acid with 2.5-diamino-1,4-benzenedithiol dihydrochloride in polyphosphoric acid with final polymer concentrations of 10 wt % and 12 wt % respectively are described on the dates as indicated above.

1,5-Naphthalenebenzobisoxazole (polymer) (02/15/02):

The high temperature polycondensation of 1,5-naphthalenedicarboxylic acid with 4,6-diamino-1,3-benzenediol dihydrochloride in polyphosphoric acid , with a final polymer concentration of 14 wt %, is described on the date indicated above.

6. All acts described herein were conducted in the United States of America before April 7, 2002.

7 I further declare that all statements made herein are of my own knowledge and are true, and that all statements made on information and belief are believed to be true; and further that the statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, Title 18, of the United States Code and that such willful false statements may jeopardize the validity of the above-identified application or any patent issue thereon.

Dated: 12/ 01/2005

Jar-Wha Lee

AFD 645 Rule 131.doc

Disclosure No. 349
Log-In-Date 2/24/03
OFFICE USE ONLY

UNIVERSITY OF DAYTON
TECHNOLOGY DISCLOSURE FORM - INVENTIONS

1. Descriptive Title of Invention

Rigid-rod Benzobisazole Polymers Incorporating Naphthalene-1,5-diyl Structural Units

2. Inventor(s)

Name (typed) (1) Thuy D. Dang

Signature Thuy Dinh Dang

Date 12/11/02

Employer Polymer Branch, AFRL/MLBP, Wright-Patterson AFB, OH 45433

Business Phone No. 937-255-0042

Home Address 6195 Millbank Drive, Centerville, OH 45459

Name (typed) (2) Dr. Narayanan Venkatasubramanian

Signature N. V

Date 12/11/02

Employer University of Dayton Research Institute, 300 College Park Drive, Dayton OH 45469

Business Phone No. 937-255-9117

Home Address 2582 King Arthur Drive Beavercreek OH 45431

Name (typed) (3) Dr. Jar-Wha Lee

Signature Jar Wha Lee

Date 12/13/02

Employer (own company) Syscom Technology Inc., 4180, Anson Drive, Hilliard, OH 43026

JWLEEST1@worldnet.att.net

Business Phone No. 614-850-7314

Home Address 1294 Darcann Drive Columbus OH 43220

Name (typed) (4) Dr. Soo-Young Park

Signature

Date

Employer (Current) Department of Polymer Science Kyungpook National University #1370 Sangyuk-dong, Buk-Gu, Daegu 702-701, Korea

Business Phone No. 82-53-950-5630

Home Address 107-1708, WhaSung 3 Cha, Dongchun-dong, Buk-Gu, Daegu 702-797, Korea

Disclosure No. _____

Log-In-Date _____

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TECHNOLOGY DISCLOSURE FORM - INVENTIONS

1. Descriptive Title of Invention

Rigid-rod Benzobisazole Polymers Incorporating Naphthalene-1,5-diyl Structural Units

2. Inventor(s)

Name(typed) (1) Thuy D. Dang

Signature

Date

Employer Polymer Branch, AFRL/MLBP, Wright-Patterson AFB, OH 45433

Business Phone No. 937-255-0042

Home Address 6195 Millbank Drive, Centerville, OH 45459

Name(typed) (2)Dr. Narayanan Venkatasubramanian

Signature

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Employer University of Dayton Research Institute, 300 College Park Drive, Dayton OH 45469

Business Phone No. 937-255-9117

Home Address 2582 King Arthur Drive Beavercreek OH 45431

Name (typed) (3) Dr. Jar-Wha Lee

Signature

Date

Employer (own company) Syscom Technology Inc., 4180, Anson Drive, Hilliard, OH 43026

Business Phone No. 614-850-7314

Home Address 1294 Darcann Drive Columbus OH 43220

Name (typed) (4) Dr. Soo-Young Park

Signature Park Soo Young

Date 12/18/2002

Employer (Current) Department of Polymer Science Kyungpook National University #1370 Sangyuk-dong, Buk-Gu, Daegu 702-701, Korea

Business Phone No. 82-53-950-5630

Home Address 107-1708, WhaSung 3 Cha, Dongchun-dong, Buk-Gu, Daegu 702-797, Korea

3. Witnesses: The disclosure shall be signed by two witnesses who are not inventors of any part of this invention.

Name (typed) Dr. Jong-Beom Baek

Signature

Date

Name (typed) Dr. Balasubramanian Sankaran

Signature

Date

Disclosure No._____
Log-In-Date _____
OFFICE USE ONLY

UNIVERSITY OF DAYTON
TECHNOLOGY DISCLOSURE FORM - INVENTIONS

1. Descriptive Title of Invention

   Rigid-rod Benzobisazole Polymers Incorporating Naphthalene-1,5-diyl Structural Units

2. Inventor(s)

Name (typed) (5) Dr. Fred E. Arnold
Signature Fred E Arnold
Date 12/30/02
Employer Polymer Branch, AFRL/MLBP, Wright-Patterson AFB, OH 45433
Business Phone No.
Home Address 1583 Ambridge Road, Centerville OH 45459

Name (typed) (6) Dr. Barry L. Farmer
Signature
Date
Employer Materials Directorate, AFRL/ML, Wright-Patterson AFB, Dayton, OH 45433
Business Phone No. 937-255-6825
Home Address 1522 Kathy Marie Ct., Xenia, OH 45385

Name (typed)
Signature
Date
Employer
Business Phone No.
Home Address

Name (typed)
Signature
Date
Employer
Business Phone No.
Home Address

3. Witnesses: The disclosure shall be signed by two witnesses who are not inventors of any part of this invention.

Name (typed) Dr. Jong-Beom Baek
Signature
Date

Name (typed) Dr. Balasubramanian Sankaran
Signature
Date

Disclosure No._____
Log-In-Date _____
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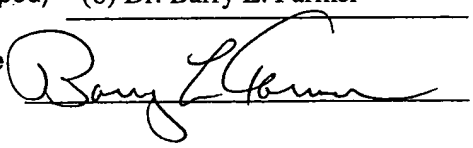
UNIVERSITY OF DAYTON
TECHNOLOGY DISCLOSURE FORM - INVENTIONS

1. Descriptive Title of Invention

   Rigid-rod Benzobisazole Polymers Incorporating Naphthalene-1,5-diyl Structural Units

2. Inventor(s)

Name (typed) (5) Dr. Fred E. Arnold
Signature _____
Date _____
Employer Polymer Branch, AFRL/MLBP, Wright-Patterson AFB, OH 45433
Business Phone No. _____
Home Address 1583 Ambridge Road, Centerville OH 45459

Name (typed) (6) Dr. Barry L. Farmer
Signature 
Date _____
Employer Materials Directorate, AFRL/ML, Wright-Patterson AFB, Dayton, OH 45433
Business Phone No. 937-255-6825
Home Address 1522 Kathy Marie Ct., Xenia, OH 45385

Name (typed) _____
Signature _____
Date _____
Employer _____
Business Phone No. _____
Home Address _____

Name (typed) _____
Signature _____
Date _____
Employer _____
Business Phone No. _____
Home Address _____

3. Witnesses: The disclosure shall be signed by two witnesses who are not inventors of any part of this invention.

Name (typed) Dr. Jong-Beom Baek
Signature _____
Date

Name (typed) Dr. Balasubramanian Sankaran
Signature _____
Date

3. Witnesses: The disclosure shall be signed by two witnesses who are not inventors of any part of this invention.

Name (typed) Dr. Jong-Beom Baek	Name (typed) Dr. Balasubramanian Sankaran
Signature Baek Jongbeom	Signature
Date 12/27/02	Date 12/23/02

4. Approval: The disclosure shall be signed by the Research Institute division head and/or the academic department chair as applicable.

Name (typed) CHYI-SHAN WANG Name (typed) ALLAN S. CRASTO

Signature [signature] Signature [signature]

Date 01/14/03 Date 1-17-03

5. Was the work leading to the invention performed (in whole or in part) on an externally sponsored program? ☐ Yes ☐ No

Sponsoring Agency/Firm AFOSR and Wright-patterson AFB

Account Number 2423010362 Contract Number F33615-00-D-5008

6. Date and circumstances of first verifiable record of the invention:

The synthesis of the monomer, i.e., 1,5-naphthalenedicarboxylic acid by the hydrolysis of the corresponding dinitrile was reported on 07/23/01. The synthesis of the polybenzobisthiazole composition incorporating naphthalene-1,5-diyl structural unit was first reported on 08/28/01.

7. Date and description of other written records of the invention predating this disclosure:

The preparation of the polybenzobisthiazole composition incorporating naphthalene-1,5-diyl unit was again reported on 11/27/01, varying the polymer concentration in the polyphosphoric acid medium. The synthesis of the corresponding polybenzobisoxazole composition was reported on 02/15/02.

8. Is there a laboratory notebook record of this invention? ☒ Yes ☐ No

Notebook number or other identification UDRI # 768 and # 789

Page numbers # 768 (page #s 76, 83), # 789 (page #s 1 and 20).

9. Has the invention been demonstrated experimentally? ☒ Yes ☐ No

Date 08/28/01 and 02/15/02 Where and How (explain below):

The compositions were synthesized in high molecular weights as evidenced by their intrinsic viscosities and displayed the lyotropic liquid crystallinity characteristic of rigid-rod polymers. Both the polybenzobisthiazole and the polybenzobisoxazole compositions were continuously spun into fibers from the anisotropic polyphosphoric acid dopes by a dry jet-wet spinning method with draw ratios ranging from 20-35 by one of the co-inventors, Dr. Jar Wha Lee.

10. First Public Disclosure. Identify the names, places, and dates associated with the first disclosure of pertinent details of the invention to anyone outside the University without the benefit of a formal confidentiality agreement. Public disclosure may be made in the following ways: (1) an oral presentation to a scientific meeting or an informal group;(2) circulation of an abstract of a talk; (3) publication of a journal article or news story; (4) delivery and distribution of a contract report, etc. Attach copies of any publications. If you are not sure whether public disclosure has been made, give the details of all external communication concerning the invention. If there has been no outside disclosure, so indicate.

    The first public disclosure appeared as "Polymer Preprints" published by the Polymer Division, American Chemical Society. The papers were presented at the annual Spring ACS Meeting at Orlando, Florida, April 7-11, 2002; the citations are given below.

    1. " Synthesis and Characterization of Rigid-rod Benzobisazole Polymers Incorporating Naphthalene-2,6- and 1,5-diyl Structural Units", Thuy D. Dang, N. Venkatasubramanian, Adam Talicska, Soo-Young Park and Fred E. Arnold, Polymer Preprints (ACS), 2002, 43(1), 660-661

    2. " Structural Studies on Naphthalene-based Rigid-rod Benzobisthiazole Polymers", Soo-Young Park, Jarwha Lee, N. Venkatasubramanian, Thuy D. Dang, Fred E. Arnold and B. L. Farmer, Polymer Preprints, 2002, 43(1), 248-249

11. Sale of Product. Has a purchase order been accepted for sale of the result of the invention in any form?
    ☐ Yes ☒ No

    If YES, please provide pertinent details

12. Samples. Have samples of the invention been given to anyone outside the University for evaluation (including sponsors)? ☒ Yes ☐ No

    Please provide pertinent details:

    Dr. Soo-Young Park, our research collaborator and faculty member in the Dept. of Polymer Science, Kyungpook National University is currently evaluating the mechanical properties of as spun and heat treated fibers including their compressive modulus and strength.

13. What do you see as the commercial value of the invention? What is the market and how large is it?

    The commercial value of the inventions stems from their potential for utilization as reinforcing, non-conducting high tenacity polymeric fibers in structural composites. The scope for commercial utility of these fibers is dependent on significant improvement in compressive strength relative to the state of-art rigid-rod polymeric fibers such as PBO.

14. List the names of firms that might be interested in licensing the invention.

15. Attach to this form a Nonconfidential Abstract of the invention addressing the items listed below:

(a) Description. Provide a brief general description that communicates the essence of the invention without disclosing pertinent technical details.

(b) Application. Intended use of the invention, especially for commercial purposes. Be specific.

(c) Advantages. What is new and useful about the invention? Why is it better than the prior art?

(d) Current State of Development. Is the invention a concept only, fully developed and ready to license, or somewhere in between? Give some idea of how much development work would be needed to commercialize the invention.

16. Attach to this form a Detailed Description of the invention according to the following instructions. Type the description space-and-a-half, use as many pages as necessary, and number the pages consecutively. Prepare the Detailed Description so an individual reasonably skilled in the art would readily recognize what is new, different, useful, and non-obvious about the invention. Try to communicate the central essence of the invention. Use photographs, sketches, and graphs as necessary. Include the following elements in the description:

(a) Intent. Briefly identify the problem and/or need addressed by the invention.

(b) Applicability. Describe the invention's general areas of application and specific uses.

(c) Function. Describe in detail the pertinent features of the invention with emphasis on (1) novelty, (2) advantages, (3) disadvantages and limitations, and (4) prior related inventions.

(d) Inventors' Roles. If more than one inventor contributed to the invention, describe the individual roles and contributions of each inventor to either the concept or its successful reduction to practice.

Submit completed disclosure form to:

THE UNIVERSITY OF DAYTON
Research Institute
Technology Commercialization Office
KL 503
300 College Park
Dayton, OH 45469-0102
Telephone 937-229-3515
Fax 937-229-3433